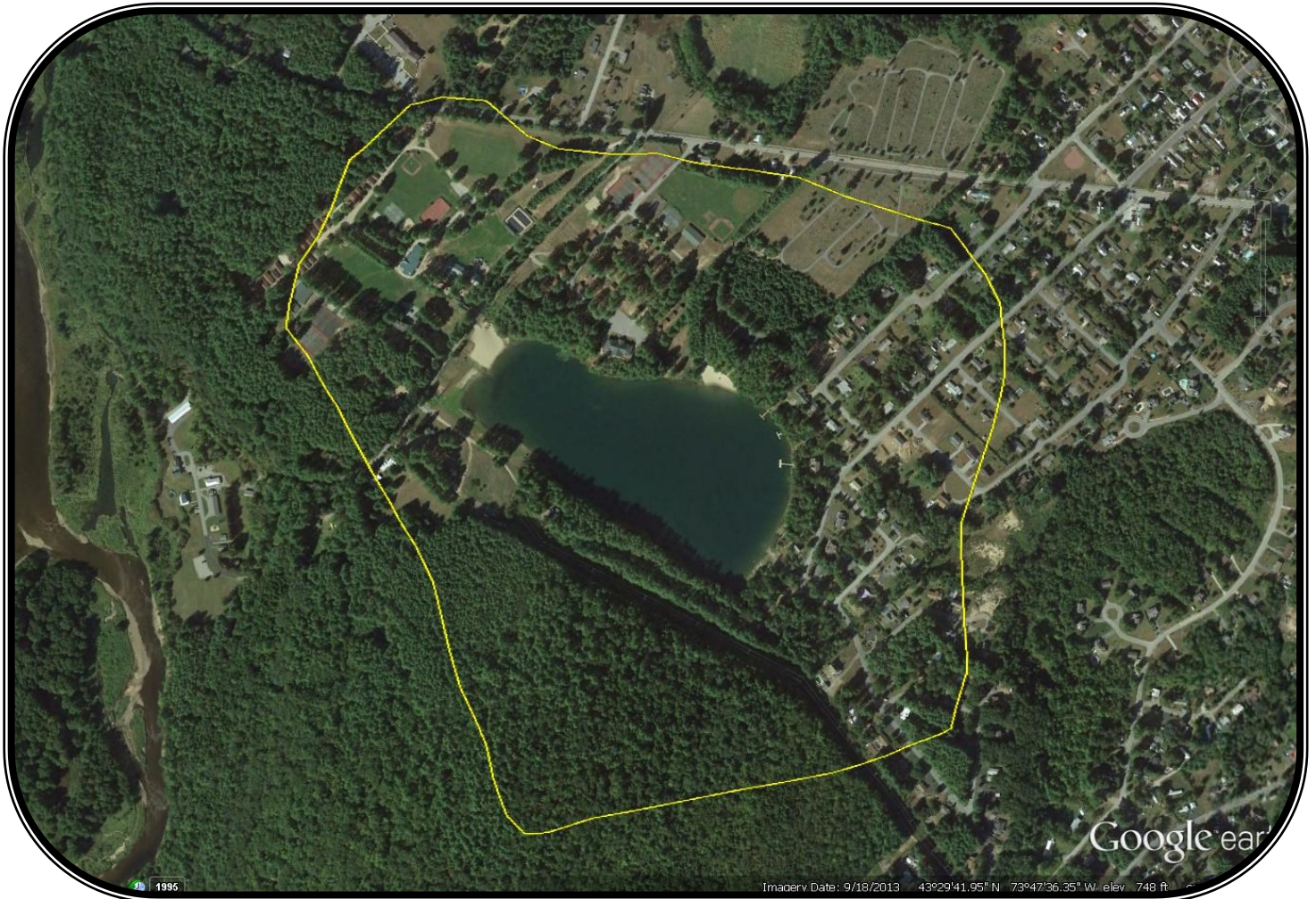


Echo Lake Water Quality Assessment

For the Town of Warrensburg



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Introduction

The Warren County Soil and Water Conservation District was approached by the Town of Warrensburg for assistance with an assessment of the conditions of Echo Lake. A local landowner had contacted the Town with concerns over both lake levels and the general appearance of the lake. The District has extensive experience in both stormwater and watershed assessments. This report will provide to the Town a number of parameters with which to evaluate the current condition of Echo lake.

Location

Echo Lake is located in central Warren County, New York. The 0.28 square mile (180-200 acres) watershed covers a small portion north of the Hamlet of Warrensburg. The lake is bounded on three sides by roads; Lake Avenue to the east, Echo Lake Road to the west and well away to the north, Golf Course Road. (see watershed map and aerial photograph in appendix)

Physical Characteristics

Echo Lake is a kettle lake or seepage lake likely formed during the end of the last glacial period. Kettle lakes have no permanent inlets or outlets and are charged primarily by ground water. They are to a lesser degree influenced by direct precipitation to their surface and surface runoff from the nearby watershed. The surface area of Echo Lake is approximately 24 acres, with roughly 4,500 ft of shoreline. The deepest location (Z_{\max}) located was 5.8 meters (19.1 feet). Approximately 38% of the shoreline is developed with either seasonal or year-round housing, 40% is cleared lands of lawn or beached areas and 22% is undeveloped. The percentage of forested watershed lands is approximately 51%.

Water clarity: Clarity in the lake was determined using a secchi disc (8" metal disc suspended from a metered line). The secchi reading was 2.3 meters (7.6 feet). This reading is average for small lakes or ponds, visibility within the lake would be considered on the low end of fair.

Stratification: Deep lakes will stratify thermally during the summer. This means that during mid-summer a lake will separate its water top from bottom; the top layer called the epilimnion (warm), the bottom layer is called the hypolimnion (cold), waters do not mix between the two layers. Echo Lake was not stratified at the time of the survey. Water temperatures in Echo Lake are close to the same from the surface to bottom with only a change of 1.4°C in 5.5 meters (2.7°F in 18 ft.). This is not surprising with a lake this shallow, given the weather we have had this year.

Dissolved Oxygen : O^2 levels throughout the water column were supersaturated, meaning that for the waters temperature, oxygen concentrations were above the normal concentrations regularly found at this altitude.

Chemistry

pH: The measure of Hydrogen (H^+) ions found in water in comparison to (OH^-) ions. If the ratio is 1:1 then the pH is 7.0 (neutral), below 7 a solution is considered acidic, above 7 it is basic. The pH of Echo Lake was 8.25 which is higher than the norm but not highly unusual. This number may be higher than the lakes average pH.

Specific Conductance : Specific conductance, or conductivity is the measure of a water's ability to pass an electrical current. This measures both the presence of dissolved salts and/or inorganic materials within water. The specific conductance for Echo was 455.1 which is higher than most lake water in this area. This may be due to the presence of road salts in the lake.



Alkalinity: A measure of the calcium carbonate (CaCO₃) in the water. A measurement of 0-60 mg/L are considered soft water and 61 mg/L and up are considered hard water. The alkalinity of Echo Lake is 48.2 mg/L so the lake has soft water on the upper end of the scale, but with a good buffering capacity so acid rain should never be a concern.

Chlorophyll: Chlorophyll_A found within the water column is used to measure the amount of phytoplankton or algae growing within the lake. The reading of 6.56 ug/L is *slightly* higher than what is usually seen in seepage lakes.

Total Phosphorus: In freshwater systems, phosphorus is the limiting factor for plant growth. Echo Lake's total phosphorus findings are what we would expect for a seepage lake. The measurement of 1 0.9 ug/L is low, and its concentration is expected for an oligotrophic lake.

Total Nitrogen: Nitrogen which makes up just under 80% of our atmospheres gases is the second most limiting factor for plant growth in our waters. Echo Lake's reading of 0.5 mg/L is exactly the reading we would expect to find.

Aquatic Vegetation

From a surface inspection of the lake, it was estimated that aquatic vegetation coverage was less than 10% of the lake area. Light penetration in waters under 6 meters (19 ft.) with a secchi reading of 2.3 meters (7.6 ft.) would allow plants to grow over nearly the entire lake bottom; this area is called the littoral zone. Echo Lake's littoral zone would cover close to 95% of the lakes bottom.

The limited number of aquatic species found in our survey were all native plants found in most waterbodies locally. The only invasive plants noted was the Common Reed (*Phragmites australis*), which was found along approximately 20% of the shoreline. Native plants obtained during the survey were Floating Leaf Pondweed (*Potamogeton natans*), Narrow Leaf Pondweed (*P. pusillus*), American Pondweed (*Stuckenia pectinata*), Water Nymph (*Najas flexilis*), Needle Spike-rush (*Eleocharis acicularis*) and a macro-algae known as muskgrass or stonewort (*Chara sp.*).

Trophic State Indices (Levels)

A lake or pond's water quality is quantified by using a Trophic State Indices or TSI (Carlson, R.E. 1975). Ranking a waterbodies chemical, biological and transparency findings and using them to compute a trophic state evaluation as a method to judge the condition of a waterbody. If you look at the amount of phosphorus (chemical) found in a lake, compare it along with its chlorophyll_A amounts (biological) and its transparency (secchi reading) you can describe the condition of a waterbody in terms of over all health. Water bodies fall under four categories in the TSI ; **Oligotrophic** - low nutrient and low productivity; high transparency (deep secchi depth), low chlorophyll-a, low phosphorus. **Mesotrophic** - moderately productive; intermediate clarity, chlorophyll and phosphorus concentration. **Eutrophic** - high productivity and high nutrient; low clarity/shallow secchi; high chlorophyll and high phosphorus concentrations. **Hypereutrophic** - extremely productivity with surface layers of algae and or aquatic vegetation.

TI	Chl	P	SD	Trophic Class
<30 - 40	0 - 2.6	0 - 12	>8 - 4	Oligotrophic
40 - 50	2.6 - 20	12 - 24	4 - 2	Mesotrophic
50 - 70	20 - 56	24 - 96	2 - 0.5	Eutrophic
70 - 100+	56 - 155+	96 - 384+	0.5- <0.25	Hypereutrophic

Conclusion

The Echo Lake survey suggests that its current condition would be moving from an oligotrophic state to a mesotrophic state. The phosphorus levels would be those found in weakly oligotrophic waters, commonly seen in seepage lakes. Chlorophyll and secchi readings suggest levels are more in line with a mesotrophic waterbody. Due to the lack of rooted aquatic vegetation within the water column, also common in seepage lakes, the phosphorus that is present in the lake is used by phytoplankton (algae); microscopic organisms that use photosynthesis for energy production. Phytoplankton is the most likely reason for the low secchi readings, lake coloration and oxygen levels recorded during our survey. During photosynthesis, CO₂ is used by phytoplankton to produce energy, O₂ is a by-product of that reaction; the results found during the survey, extremely high O₂ levels and above normal pH are likely caused by this reaction.

The day of the survey was one of many hot, sunny days this summer; the late afternoon sampling gave us a pH of 8.25, oxygen levels above saturation of 9.52 mg/L @ 79.7 ° F and a secchi reading of 2.3 meters (7.6ft). During photosynthesis, phytoplankton's removal of CO₂ from the water column would cause a rise in pH, releases O₂ into the water column causing super saturation and an increase in phytoplankton reproduction would reduce the transparency of the water.

In addition, the weather patterns since last summer seem to be out of the norm. To date local rain gauges have recorded about 15" of precipitation through mid August, we have an average 43" of precipitation annually. With a relatively mild fall and early winter, a limited snow pack and a particularly dry spring and summer, the water level of the lake is down approximately 1'-1.5' feet, which would be approximately 12 million gallons of water. The reduction of water volume concentrates both the phosphorus and phytoplankton into a smaller area within the water column. It also reduces the amount of nutrients taken up by the one invasive species we found in the lake. Along the shoreline, much of the common reed (*Phragmites australis*) is now outside of the lake's plant growth zone (littoral zone). The receding waterline has removed these plants from the water column, phosphorus that would have been taken up by these large plants is now available to the phytoplankton.

This assessment is a snap-shot of the lake, on July 20th 2016 at 2:00 pm. That is not to say that these results can't be indicative of the lake's overall condition, but it is difficult to make sweeping conclusions with a single data point. Generally speaking, the conclusion that could be drawn from this sampling is that the lake is in fairly good condition, but it bears watching. The specific conductance found in the lake may be a sign of high road salt levels in the ground water table, however it may also be from high bicarbonate levels as shown in the moderate alkalinity level seen in the lake or a combination of both. Many of these results may change with a return back to normal lake levels.



Images of Aquatic Vegetation found in Echo Lake



Najas flexilis



Chara sp.



Eleocharis acicularis



Potamogeton natans



Stuckenia pectinata

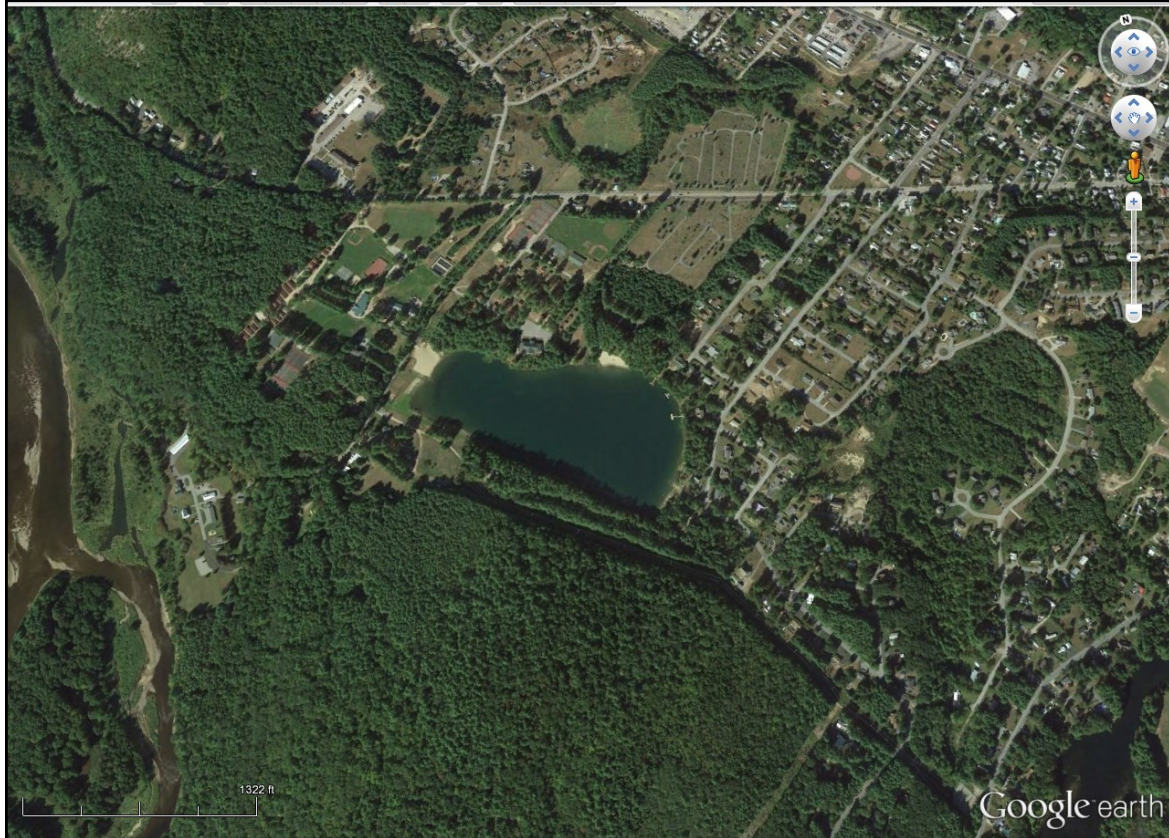


Phragmites australis (exotic)



Potamogeton pusillus

Aerial Photographs Google Earth Echo Lake



Echo Lake Watershed Map From USGS StreamStats

